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(54) Method and apparatus for providing security indicia on a substrate

(57) A method of providing security indicia on a substrate comprises providing a transfer sheet comprising a carrier sheet and a releasable layer comprising a varnish layer and a layer of temperature-sensitive adhesive, the varnish layer being adjacent to the carrier sheet; producing a toner image of the indicia on the adhesive layer; positioning the transfer sheet on the substrate with the adhesive layer facing the substrate; thermally transferring to the substrate the toner image of the indicia, the adhesive layer, and the varnish layer; and removing the carrier sheet. The method is particularly useful for providing security indicia in passport books.

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Description

Field of the Invention

The invention relates to a method and apparatus for providing security indicia on a substrate. In particular, the invention is concerned with providing such security indicia on a page of a pre-formed book, such as a passport.

Background of the Invention

A conventional method of providing security indicia in passports involves sticking a photograph of the passport bearer onto a page of the passport, eg. one of the inside covers, and printing biometric data directly onto that so as to coincide with pre-printed headings thereon. In order to protect the security indicia from tampering it is usual to cover them with a plastics sheet comprising on one surface a pressure sensitive or temperature-sensitive adhesive. Typically, this sheet will be stitched into the core of the passport book, with a removable release paper on the adhesive side, adjacent the page it is intended to protect.

This method has a number of disadvantages. Firstly, while the plastics cover sheet is intended to protect the security indicia from tampering, it is ineffective in this respect as in some instances it can be peeled back. Secondly, the printing of biometric data onto a pre-formed book to the necessary, government regulated, standards of registration is difficult, and can result in failure with the passport book having to be discarded, which is expensive.

Various proposals have been made to providing security indicia utilising transfer imaging techniques. For instance, WO-A-9012694 discloses a method in which an image is produced on a glue layer on a transparent carrier, and is then thermally bonded, with the glue and the carrier, to a substrate.

US-A-4006050 discloses a security document, in the form of a card, produced by forming on a carrier sheet a xerographic image, and subsequently transferring this to a plastics base with removal of the carrier sheet. Optionally, a varnish layer can be provided between the carrier sheet and the image, and this will then be outermost in the final card.

The methods described above are relatively complex, and not ideally suited to the secure, mass production of documents such as passports and, in particular, are not ideally suited to produce security indicia on pages of a pre-formed book.

Summary of the Invention

In accordance with a first aspect of the present invention, a method of providing security indicia on a substrate comprises providing a transfer sheet comprising a carrier sheet and a releasable layer comprising a varnish layer and a layer of temperature-sensitive adhesive, the varnish layer being adjacent the carrier sheet; producing a toner image of the indicia on the adhesive layer; positioning the transfer sheet on the substrate with the adhesive layer facing the substrate; thermally transferring to the substrate the toner image of the indicia, the adhesive layer, and the varnish layer; and removing the carrier sheet.

The method of the present invention is simple and accurate, and is well-suited to mass production. In addition, when used to prepare a passport, the final product is significantly more tamper-proof than passports made by conventional methods.

According to a second aspect of the present invention, apparatus for providing security indicia on a substrate comprises spaced apart receiving means for a substrate and for a transfer sheet comprising a carrier sheet and a release layer on to which a toner image of security indicia is provided; a registration system for registering the transfer sheet with the substrate; and means for transporting each of the transfer sheet and the substrate from the receiving means to a thermal transfer zone, the thermal transfer zone comprising thermal transfer means for thermally transferring the toner image from the transfer sheet to the substrate. Preferably, the transfer sheet and the substrate are transported substantially in register from the receiving means to the thermal transfer zone.

A principal advantage of the apparatus is that it achieves automatic registration of the transfer sheet, and therefore the security indicia thereon, with the passport. A further advantage is that, in its preferred form (see below), the apparatus is relatively compact and portable, and is therefore suitable for users on all scales and of all economies.

According to further aspects of the present invention, a laminate and a passport book are defined in claims 24 and 25.

Description of the Invention

The transfer sheet typically comprises a paper carrier, or other release paper, onto which a varnish and an adhesive layer are then coated. Preferably the surface of the carrier paper to be coated has a matt finish, so that on transfer of the varnish and adhesive layers to the passport a matt top surface is provided in the final product.

The function of the varnish layer is two-fold. First, it acts to release the security indicia from the carrier sheet. An important feature of the varnish layer, therefore, is its activation temperature, as it needs to be stable at toner printing temperatures, but at the higher "transfer" temperatures it needs to release cleanly from the carrier paper allowing transfer to the passport. Second, the varnish layer provides a relatively hard, protective outer coat in the final product, thereby preventing damage to and/or effective tampering with the underlying security

indicia.

Suitable materials for use as the varnish layer include acrylic polymers and copolymers.

The thickness of the varnish layer is typically below about 10 μm, eg. 3-4 μm, in order to allow clean transfer from the carrier paper to the passport, and to provide a more tamper-evident surface; the thinner this layer is, the more difficult it is to lift clearly during counterfeit attempts.

The varnish layer may be printed with security features, such as security patterns and the like, and this may be achieved using special security inks, such as fluorescent inks, or UV or IR-sensitive inks. Indeed, the varnish layer can be printed with a number of different types of security feature. Alternatively, a number of varnish layers can be provided, each printed with one or more types of security feature. In this case, each varnish layer can be composed of the same or a different material.

Preferably, the security features in the varnish layer are screen-printed. Screen printing offers a simple and cost-effective way of applying a wide range of security materials . These materials may provide visible security in the form of lustrous or optically-variable print which cannot be reproduced by colour copiers or standard lithographic techniques; the screen process is particularly suited to the printing of optical materials. Alternatively, or additionally, materials that provide invisible security, eg. in the form of fluorescence, phosphorescence, etc, or which are photochromic, may be used. The method of the present invention is particularly suited to the printing of invisible security features, as the presence of the outer varnish layer in the final product obscures the gloss of the invisible ink that is normally associated with such features.

The adhesive used in the present invention is a temperature-sensitive adhesive. A suitable example is polyurethane adhesive. The thickness of the adhesive layer is typically below about 20 μm.

The toner image is produced directly onto the adhesive layer, and on bonding to the passport becomes intimately mixed therewith. The adhesive layer can itself comprise further security features of the usual types. However, it may be simpler, and more effective, to avoid printed security features in this layer, other than the toner image, but instead use a fluorescent or photochromic material, for instance, dispersed throughout the adhesive layer.

The security indicia will typically comprise personalised information such as a person's name, photo image, identification number, bar code, fingerprint, signature, or the like. Some of the indicia, eg. a photo image, may be in colour, but most will typically be in monochrome. This information will typically be gathered together during an enrolment process, and digitized for subsequent use during the colour toner imaging step. In one, preferred, embodiment of the invention, the security indicia are printed in reverse, ie. as a mirror image, so that on transfer they appear the correct way round on the substrate.

The step of producing the toner image is carried out using a conventional colour laser printer, eg. printers such as Tektronix 540 Plus, Xerox 4920, and the Canon CLC range of printers.

The substrate, eg. a passport, itself can be preprinted with security features in a conventional manner, for instance, rainbow printing. Conventionally, a passport carries standard printing which will be the same for each passport, eg. country name, headings for the various biometric data etc., but this too is preferably now incorporated on the transfer sheet, thereby overcoming the registration problems experienced in the prior art.

The thermal transfer step can be carried out manually by inserting the transfer sheet and the passport into a thermal transfer apparatus of conventional form, but conveniently, and to avert operator error, it can be carried out in accordance with the second aspect of the present invention outlined above.

The print conditions are temperature, pressure and time dependent and these must be controlled within the tolerances required by the print process, which will depend to an extent on the materials used in the transfer sheet, as explained above. Typically, however, the thermal transfer temperature will be in the range 90-140°C.

The thermal transfer means typically comprises a metal platen. eg of aluminium. This can be heated to a pre-set temperature by heater elements controlled in a closed loop circuit using temperature readings taken from temperature sensors in the platen.

Pressure is applied by driving the heated platen down onto the transfer sheet and substrate combination. Preferably this is achieved mechanically, eg. using a screw thread or electrically, as opposed to using a compressor so that the apparatus is suitable for desktop use. and is portable However, if desired a compressor can be used The pressure applied is typically in the range 7×10^{-3} to 35×10^{-3} kg/cm^2 (10 to 50 psi), for upto 20 seconds typically around 10 seconds. The pressure can be monitored eg using a full bridge strain gauge system located on a plate mounting the platen.

An example of a method and apparatus according to the invention will now be described with reference to the accompanying drawings in relation to providing security indicia on a passport

Figure 1 is a schematic cross-section (not to scale) illustrating a substrate and transfer sheet;

Figure 2 is a schematic cross-section (not to scale) showing an image substrate with protective film;

Figure 3 illustrates an example of the appearance of coloured security indicia on a transfer sheet;

Figure 4 illustrates the coloured security indicia shown in Figure 3 after transfer onto a substrate;

Figures 5a to 5c illustrate apparatus for carrying out the transfer process Figure 5a is an internal view from the front Figure 5b is a front view, and Figure

5c is an internal plan view; and

Figure 6a is a plan view of the registration means of the apparatus, and Figures 6b to 6d show different steps in the registration sequence.

Figure 1 illustrates a substrate 1 which may be, for example, a paper sheet forming the back page of a passport and on which security printing indicated schematically at 2 is provided. The security printing may be rainbow printing or other security features of a conventional type.

In the process, initially a transfer sheet 3 is provided comprising a paper carrier 4 onto which have been coated a layer of an acrylic-based varnish 5 and an adhesive layer 6 which will accept and retain one or more colour toners.

Digital data defining the security indicia which are to be provided on the transfer sheet 3 are generated and stored. This may be, for example, by manually inputting the data such as the holder's name, address, passport number and the like and/or by scanning images of this information and other information. For example, a photo image of the passport holder may be scanned. This data is then used by a conventional colour toner imaging apparatus to which is fed the transfer sheet 4. The colour laser copier forms a toner image 7 of the digital data on the adhesive layer 6.

The appearance of the transfer sheet 3 after printing with security indicia is shown in Figure 3a. As can be seen, the security indicia includes the holder's photo image 8 and other data relating to the holder such as his name 9, passport number 10, date of birth 11, etc. Also, standard printing 12 of the type present in each passport is incorporated. The transfer sheet also has a reference block 13 printed thereon which enables accurate positioning of the sheet in the transfer apparatus, so as to achieve precise alignment of the security indicia on the passport. Figure 3b shows another transfer sheet including data 14 on the bearer's children, and this can be used on another page of the passport, eg. the page facing the machine-readable page.

The imaged transfer sheet 3 is then placed in contact with the substrate 1 with the adhesive layer 6 facing the substrate 1 and this structure is then placed into a thermal transfer apparatus which applies heat causing the varnish layer 5 and the adhesive layer 6 carrying security indicia 7 to be released from the carrier and to transfer onto the substrate 1. This can be seen in Figure 2.

The appearance of the finished product can be seen in Figure 4.

Referring to Figures 5a to 5c, the apparatus is mounted in a housing 50 and includes a heater platen 51 which is vertically movably mounted above a stage 52, which typically consists of a silicone rubber layer to maintain even pressure during transfer. The housing has an upper slot 53 and a lower slot 54 to receive a transfer sheet (not shown) and an open passport book (not shown), respectively. A display 55 allows the operator to monitor the different steps in the process. A transfer mechanism 56, typically comprising a set of stepper motor-driven rollers, is mounted in the housing between upper slot and the heater platen. A similar transfer mechanism (not shown) operates between the lower slot and the stage.

Registration sensors 57 are located below the transfer mechanism, and include a number of detector cells (not shown) for determining the relative positions of the transfer sheet and the passport book. Finally, the stage is equipped with clamping means (not shown) to maintain the passport book in an open position while the transfer sheet is slid over the top, and transfer takes place.

The general mode of operation of the apparatus is now described. The operator presents a passport, face up and open at the page to be printed, into the lower slot in the front of the housing. When the passport is inserted far enough into the housing, the transfer mechanism takes over, and transports it further into the housing. The operator then presents the transfer sheet, face down, into the upper slot in the front of the housing. When the transfer sheet is inserted far enough into the housing, the transfer mechanism again takes over and transports both the passport and transfer sheet further into the housing, to start the alignment and printing process.

The passport and transfer sheet are carried to the registration system where the horizontal alignment is checked for relative position and skew. The relative vertical position is then ascertained and the distance to be moved into the area where transfer is to take place is calculated. The passport and transfer sheet are then moved to the transfer area, where they are heated to the required interface temperature and put under a specified pressure for a specified time.

On completion of transfer the carrier and passport are passed through the upper slot to the operator.

Reference is now made to Figures 6a to 6d, to describe the method and apparatus of the present invention in more detail. Referring to Figure 6a, the transport means consists of eight rubber rollers laid out as a front roller set 60 of four rollers and a rear roller set 61 of four rollers. Each set of rollers is driven by a stepper motor (not shown) that can move in either a forward or reverse direction in selectable distance increments, eg. of 0.157 mm or 0.079 mm, depending on the precision required. The transport means is controlled by a main processor (not shown) which can control each step of movement for each of the motors separately.

The measurement means shown consists of five infra red cells 62a to e, to ascertain the rough position of both the passport and transfer sheet at any time during the alignment process, and at least one Charge Coupled Device (CCD) 63 for accurate edge measurement thereof.

The infra red cells are look-through devices that detect the presence of the media as it blocks the path of

the infra red emissions. These cells detect the leading edges of the documents, eg. to an accuracy of around ±2 mm, depending on the infra red porosity characteristics of the media it is looking at.

A suitable CCD array 63 consists of 128 light sensitive cells laid out in a 16 mm long line, giving a centre to centre distance between cells of 125 μm. Set at 45°, the centre to centre distance is 88 μm, but now the CCD can be used to measure over a distance of 11 mm in both the horizontal and vertical directions. The CCD uses a light source that can be controlled by the main processor so that the optimum light condition can be set for the particular media type.

When a passport 64 is fed into the lower slot of the housing it meets the rear roller set and covers cells 62a and 62b. Cell 62a indicates that the passport has been fed into the correct slot, and cell 62b triggers the transport means into action after a short delay (eg. 250 ms), to ensure that the passport is at the rollers. The rear rollers then transport the passport until cell 62c is covered indicating that the passport has reached its initial position. The apparatus then waits for presentation of the transfer sheet.

The operator feeds the transfer sheet into the upper slot of the housing, over cell 62d, until it meets the rear roller set. Cell 62d triggers the transport means into action after a delay (eg. 250 ms), to ensure that the transfer sheet is at the rollers.

The transport means then moves the passport a known fixed distance from cell 62c to its measurement position on the CCD (see Figure 6b), taking the transfer sheet with it. The processor then calculates the distance x the passport leading edge has to travel from there to its final position 64a under the heater platen 65 (see Figure 6a), and stores this information in its memory. The processor also measures the position of the side edge of the passport on the CCD and stores this away for future use in calculating the relative horizontal positions of the documents and any skew.

The transport means then moves the transfer sheet until a printed reference block 66 thereon covers cell 62e. Use of a reference block allows for precise alignment of the security indicia. The passport is moved with the transfer sheet to an intermediate position, and the distance moved is deducted from the distance x to the passport's final position.

The transport means then moves the transfer sheet a known fixed distance from cell 62e to its measurement position on the CCD (see Figure 6c), again taking the passport with it. The processor then calculates the distance y the reference block has to travel from there to its final position 66a, under the heater platen, and stores this information in its memory. The processor also measures the position of the side edge of the reference block on the CCD and stores this for future use in calculating the relative horizontal positions of the documents and any skew.

The transport system then moves the passport the remaining distance to its final position 64a (see Figure 6d), moving the transfer sheet also, the processor deducting the distance travelled from the distance y to the final position of the reference block.

Measurements are again made of the relative horizontal positions of the reference block and the passport edge to determine that both documents are moving in such a way as to ensure their correct alignment prior to transfer printing.

Next, a clamp system (not shown) is actuated to hold the front edge of the passport in position to prevent movement thereof as the transfer sheet is moved over it and into its final position 66a, ready for transfer printing.

Claims

1. A method of providing security indicia on a substrate, the method comprising:

   providing a transfer sheet comprising a carrier sheet and a releasable layer comprising a varnish layer and a layer of temperature-sensitive adhesive, the varnish layer being adjacent to the carrier sheet;
   producing a toner image of the indicia on the adhesive layer;
   positioning the transfer sheet on the substrate with the adhesive layer facing the substrate;
   thermally transferring to the substrate the toner image of the indicia, the adhesive layer, and the varnish layer; and
   removing the carrier sheet.

2. A method according to claim 1, wherein the toner image produced on the adhesive layer is a mirror image.

3. A method according to claim 1 or claim 2, which further comprises screen-printing the varnish layer with security features.

4. A method according to claim 3, which comprises screen-printing the varnish layer with two or more different types of security feature.

5. A method according to any preceding claim, wherein the transfer sheet comprises two or more varnish layers.

6. A method according to any preceding claim, wherein the toner image is laser-printed.

7. A method according to any preceding claim, wherein the carrier comprises paper.

8. A method according to any preceding claim, where-

in the adhesive is a polyurethane adhesive.

9. A method according to any preceding claim, wherein the varnish is selected from acrylic polymers and copolymers.

10. A method according to any preceding claim, wherein the toner image comprises a photo image.

11. A method according to any preceding claim, wherein the toner image comprises personalised information other than a photo image, eg. a person's name, identification number, bar code, fingerprint, signature etc.

12. A method according to any preceding claim, wherein at least part of the toner image is in colour.

13. A method according to any preceding claim, wherein the thermal transfer step is carried out at a temperature in the range 90-140°C, using a pressure in the range 7×10^3 to 35×10^3 kg/cm^2 applied for upto 20 seconds.

14. A method according to any preceding claim, wherein the substrate comprises a page of a book.

15. A method according to any preceding claim, wherein the substrate forms part of a passport.

16. A method of providing coloured security indicia on a substrate substantially as hereinbefore described with reference to the accompanying drawings.

17. Apparatus for providing security indicia on a substrate, the apparatus comprising:

spaced apart receiving means for a substrate and for a transfer sheet comprising a carrier sheet and a release layer on which a toner image of security indicia is provided;
a registration system for registering the transfer sheet with the substrate; and
means for transporting each of the transfer sheet and the substrate from the receiving means to a thermal transfer zone, the thermal transfer zone comprising thermal transfer means for thermally transferring the coloured toner image of the indicia from the transfer sheet to the substrate.

18. Apparatus according to claim 17, wherein the transfer sheet and the substrate are transported substantially in register from the receiving means to the thermal transfer zone.

19. Apparatus according to claim 17 or claim 18, wherein the registration system comprises measuring means for determining the relative position of each of the substrate and the transfer sheet with regard to the thermal transfer means, and aligning means to align the substrate and the transfer sheet.

20. Apparatus according to any of claims 17 to 19, wherein the registration system works from the leading edge of the substrate and from a reference block printed onto the transfer sheet.

21. Apparatus according to any of claims 17 to 20, which further comprises means for checking the alignment of the transfer sheet and the substrate in the thermal transfer zone.

22. Apparatus according to any of claims 17 to 21, wherein the thermal transfer means is electrically- or mechanically-driven.

23. Apparatus according to any of claims 17 to 22, having means for maintaining a book as the substrate in an open position.

24. A laminate comprising a transfer sheet as defined in any of claims 1 to 12.

25. A passport book comprising, thermally-bonded to a page or inside cover thereof, a laminate comprising an adhesive layer carrying a toner image, and a varnish layer the adhesive layer being adjacent the page or cover of the passport book.

Fig.1.

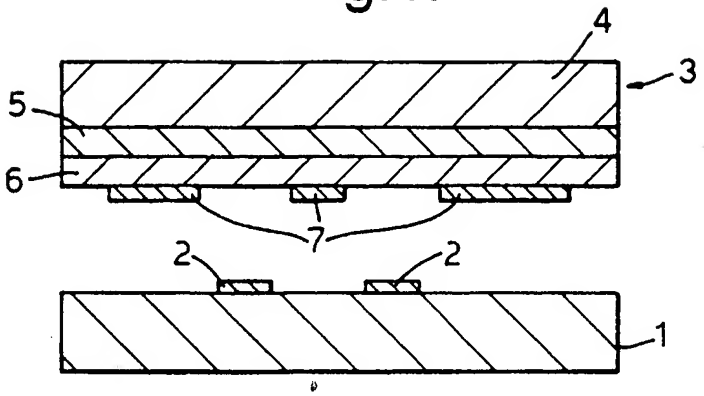


Fig.2.

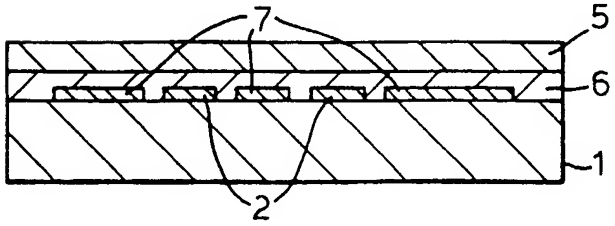


Fig.3a.

12
UTOPIA
PASSPORT
PASSEPORT
10
L898902C
UTO
P
9
FLETCHER
BRIAN CHRISTOPHER
UTOPIAN
11
02 MAY / MAI 40
ZE184226B
M
ZENITH
16 AUG / AOUT 95
PASSPORT OFFICE
16 AUG / AOUT 00
13
8
P<UTOFLETCHER<<BRIAN<CHRISTOPHER<<<<<<<<<<
L898902C<3UTO4005025M0008165ZE184226B<<<<<14

Fig.3b.

14
Children
Surname
Given names
Date of birth
Sex
Place of birth
Fletcher
Roger Martin
08/10/67
M
Essex.UK
Fletcher
Carolina Elizabeth Alice
26/1/71
F
Essex.UK

Fig.4.

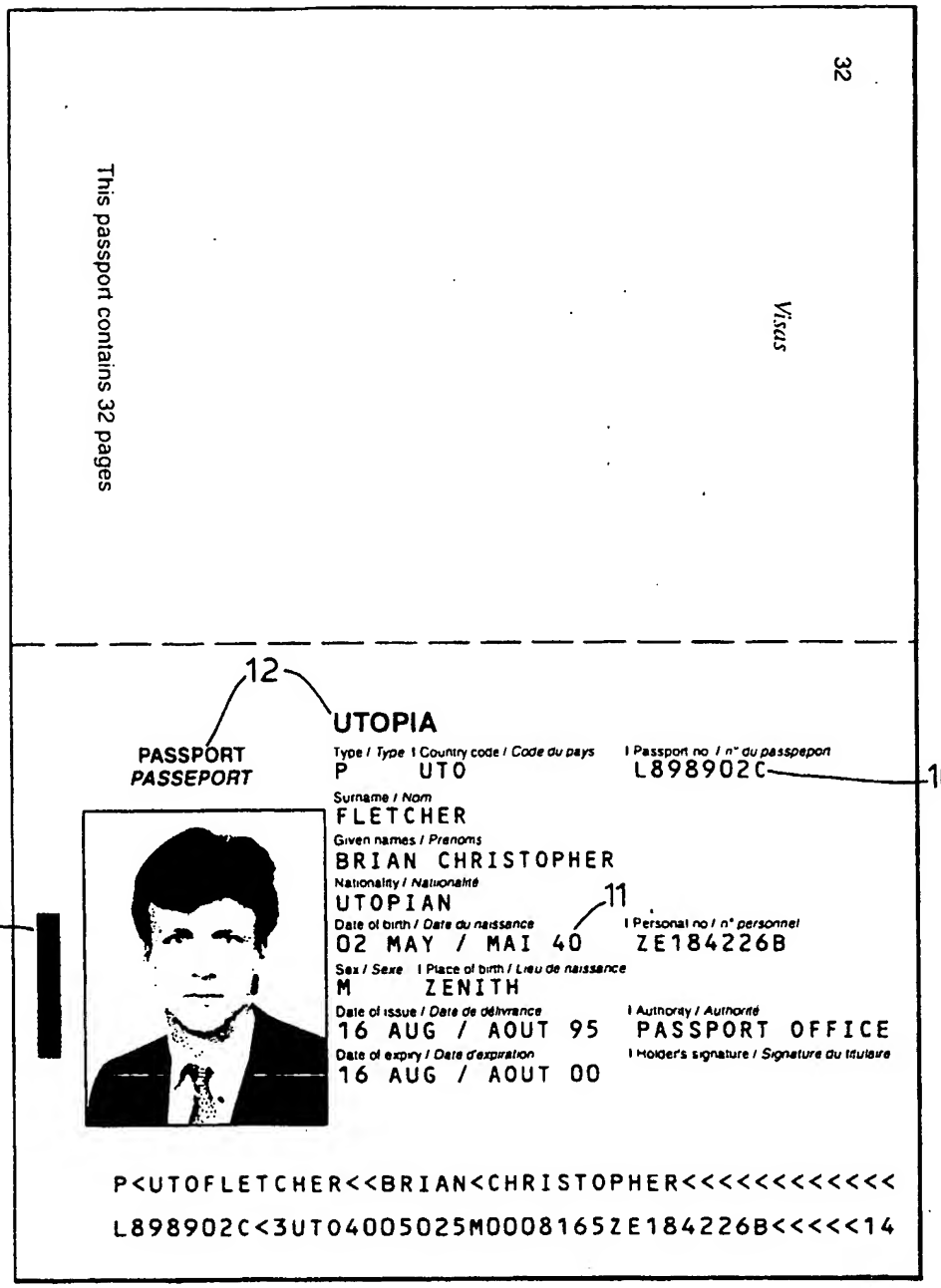

32
Visas
This passport contains 32 pages
12
UTOPIA
PASSPORT
PASSEPORT
Type / Type
P
Country code / Code du pays
UTO
Passport no / n° du passepport
L898902C
10
Surname / Nom
FLETCHER
Given names / Prenoms
BRIAN CHRISTOPHER
Nationality / Nationalité
UTOPIAN
11
Date of birth / Date du naissance
02 MAY / MAI 40
Personal no / n° personnel
ZE184226B
13
Sex / Sexe
M
Place of birth / Lieu de naissance
ZENITH
Date of issue / Date de délivrance
16 AUG / AOUT 95
Authority / Autorité
PASSPORT OFFICE
Date of expiry / Date d'expiration
16 AUG / AOUT 00
Holder's signature / Signature du titulaire
P<UTOFLETCHER<<BRIAN<CHRISTOPHER<<<<<<<<<<<<
L898902C<3UT04005025M0008165ZE184226B<<<<<14

Fig.5a.

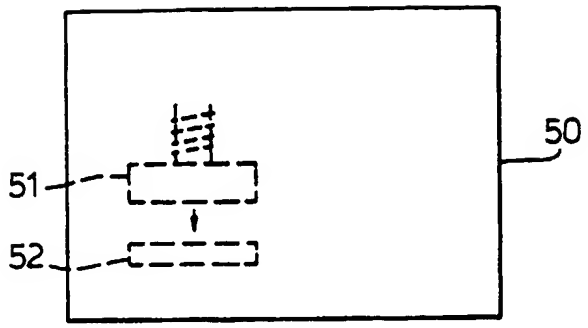


Fig.5b.

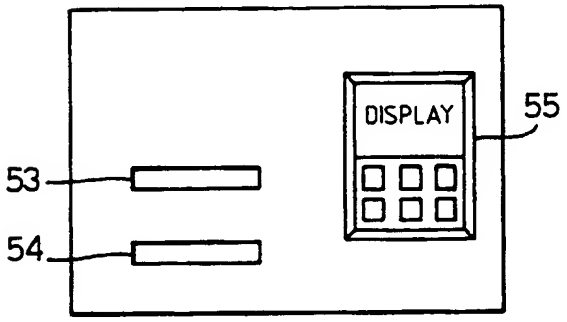


Fig.5c.

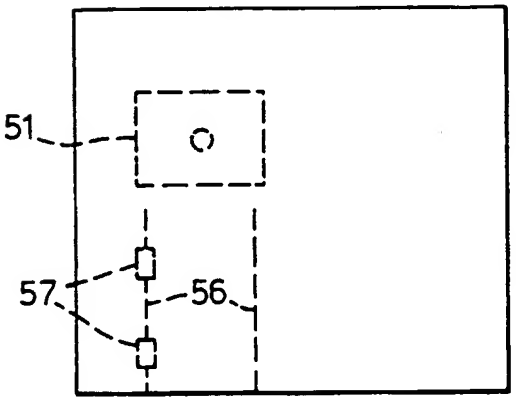


Fig.6a.

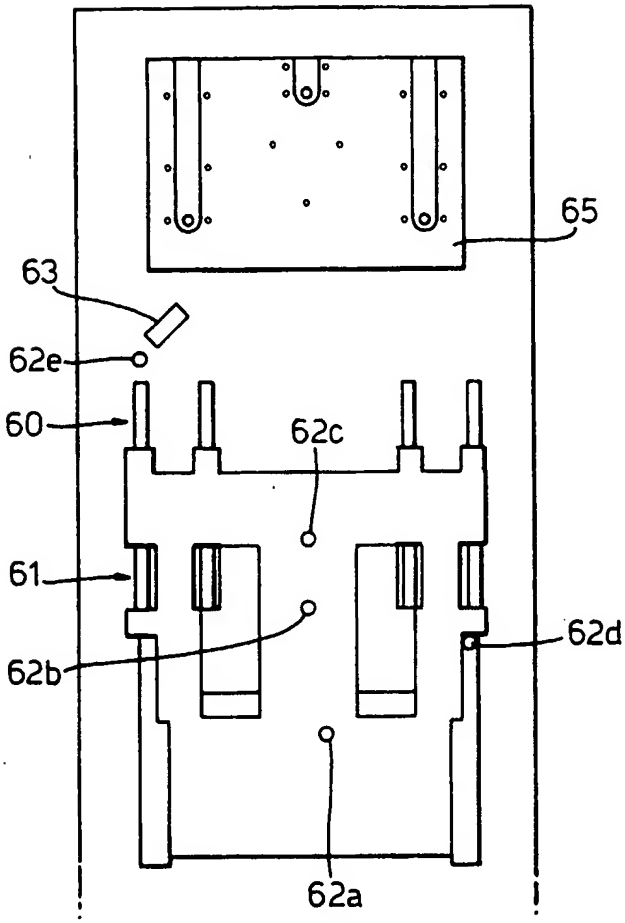


Fig.6b.

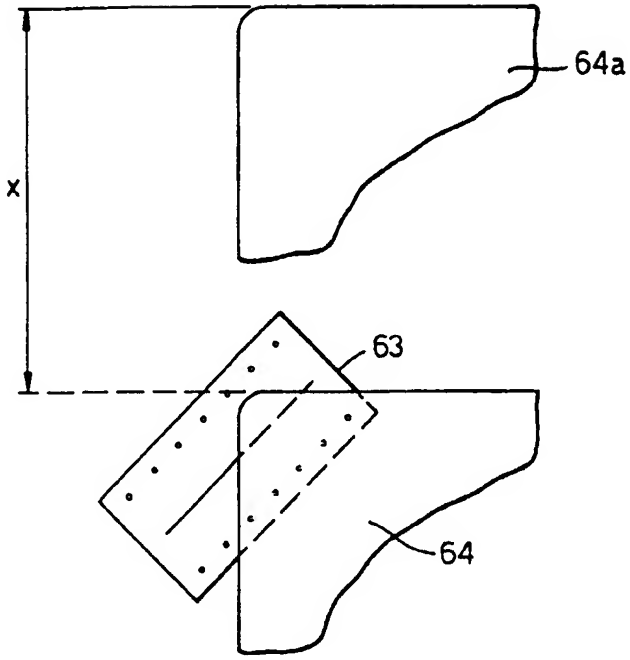


Fig.6c.

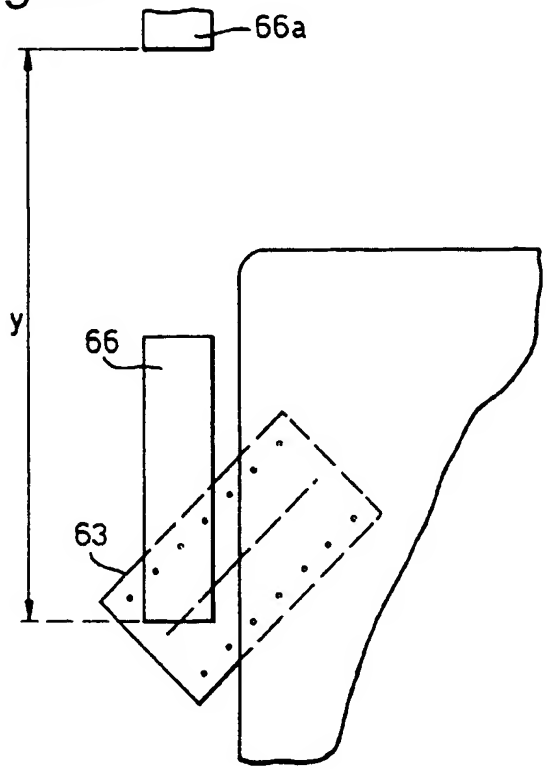
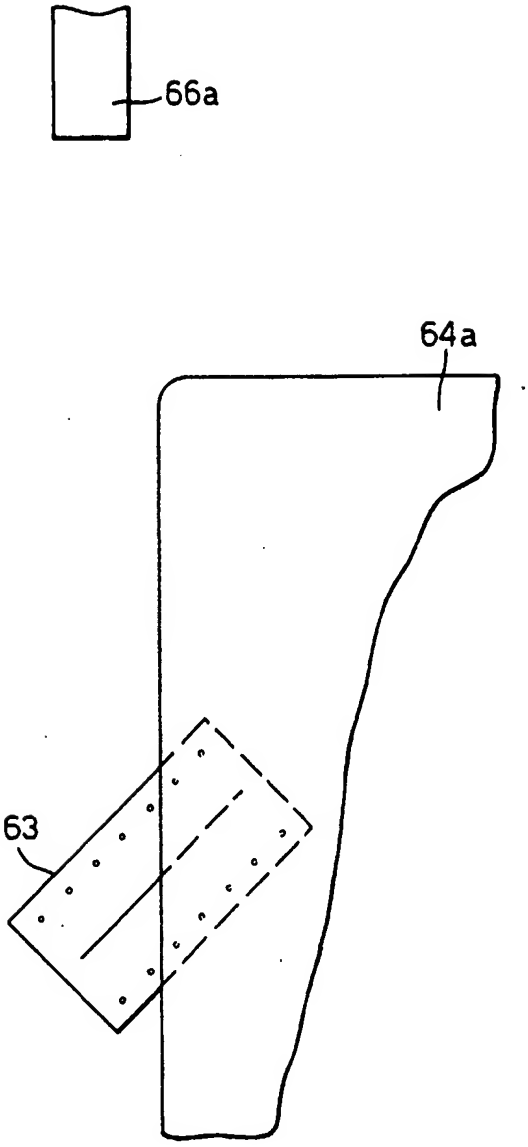


Fig.6d.



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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 30 1535

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 410 800 A (XEROX CORPORATION) 30 January 1991 * column 3, line 28 - column 4, line 45 *	17,25	G03G7/00 B44C1/14 B41M3/14
A	* column 11, line 43 - column 12, line 9; figure 1 *	1-16, 18-24	
X	GB 2 028 719 A (EASTMAN KODAK COMPANY) 12 March 1980	17,18,22	
A	* page 2, line 32 - line 90; figure 2 *	1-16, 19-21, 23-25	
D,Y	WO 90 12694 A (COMMONWEALTH OF AUSTRALIA) 1 November 1990 * page 8, line 10 - page 11, line 20; figures 1,2 *	1-7, 9-17,24, 25	
D,Y	US 4 006 050 A (HURST ET AL.) 1 February 1977 * the whole document *	1-7, 9-17,24, 25	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B41M B44C B42D G03G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 June 1998	Balsters, E

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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